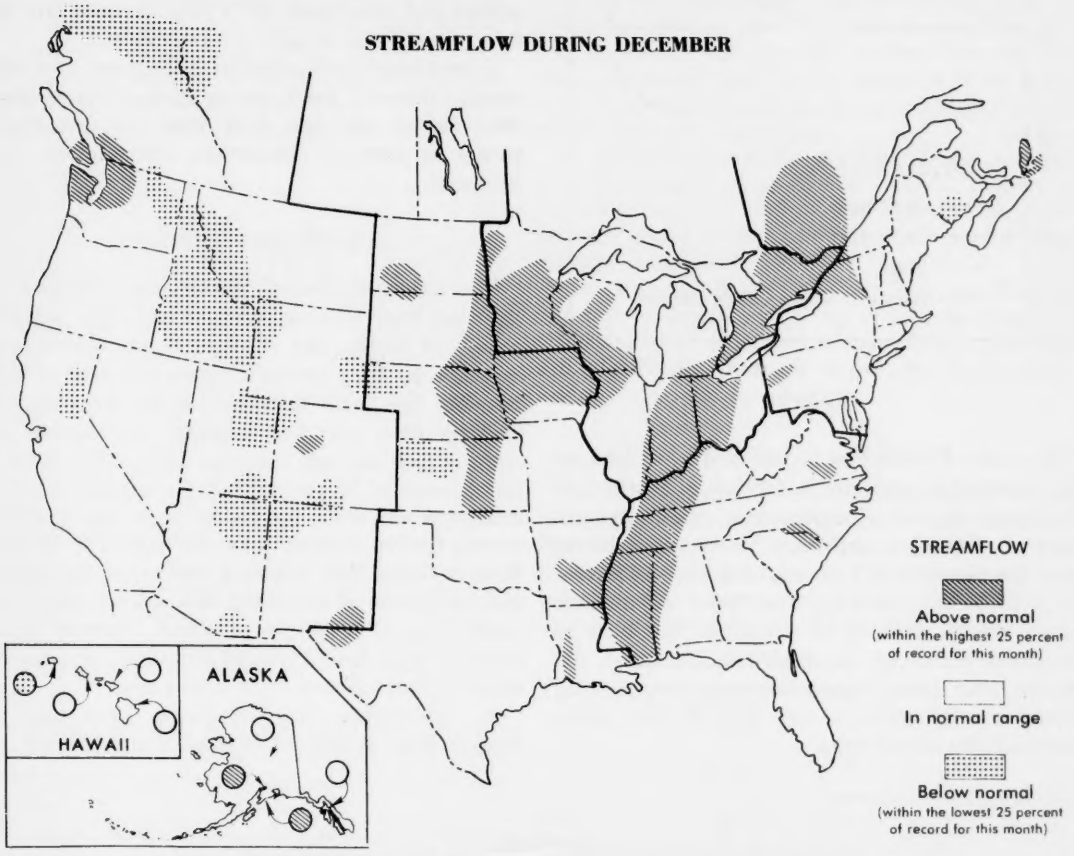
WATER RESOURCES REVIEW for DECEMBER 1979

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CANADA
DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES BRANCH



STREAMFLOW AND GROUND-WATER CONDITIONS

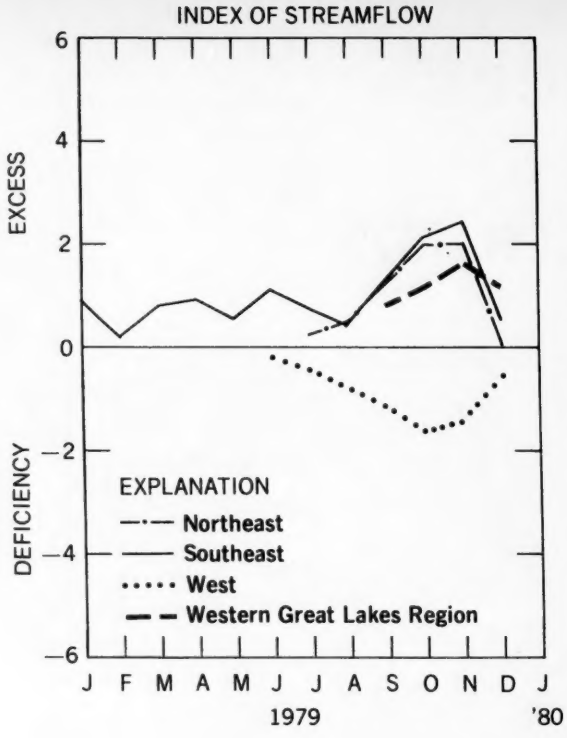
Streamflow increased seasonally in Arkansas, Kentucky, Louisiana, Nevada, Oregon, Texas, and Washington; generally decreased in southern Canada, Alaska, California, West Virginia, most North-Central and Atlantic-Coastal States; and was variable elsewhere.

Flows remained above the normal range in parts of Ontario, Quebec, Alaska, Colorado, New York, New Mexico, most States in the Southeast, Midcontinent, and Western Great Lakes Regions, and increased into that range in parts of Washington and Wyoming. Monthly and/or daily mean flows were highest of record for the month in parts of Alaska, Iowa, Minnesota, and South Dakota. Flooding occurred in Illinois, Indiana, Kentucky, Louisiana, Mississippi, Ontario, Ohio, and Washington.

Below-normal streamflow persisted in parts of Alberta, British Columbia, Arizona, Idaho, Montana, Nebraska, New Mexico, Utah, and Washington.

Ground-water levels generally declined and were near average in the Northeast Region. However, levels rose in parts of southern New England and in New York, and were above average locally in southern New England and in Maryland. In the Southeast Region, levels rose and were above average in Kentucky and North Carolina, and rose and were mostly above average in Mississippi. Levels declined but were above average in Virginia, and declined and were below average in Alabama. Trends were mixed elsewhere in the Southeast, and were above and below average. In the Western Great Lakes Region, levels declined in Wisconsin and Ohio, changed little in Indiana, and trends were mixed elsewhere. Above-average levels prevailed in the region. Rising levels prevailed in the Midcontinent, although trends were mixed locally; levels were above average in North Dakota and Iowa, below average in Kansas and Arkansas, and were above and below average elsewhere. In the West, levels rose in Nevada and Arizona, and declined or were unchanged in southern California; trends were mixed elsewhere. Levels were below average in Idaho, Arizona, and New Mexico, and mixed with respect to average elsewhere.

New high ground-water levels for December were recorded in southern California, Kentucky, Nebraska, North Carolina, Utah, and Virginia. A new alltime high was reached in Kentucky. New December lows occurred in Arizona, Idaho, Nevada, New Mexico, Texas, and Utah.



The index of streamflow is computed by multiplying the percent of a region that is deficient or excessive by the average duration of deficiency or excess. Thus the index of streamflow deficiency for the West during December decreased to a value of −0.6 when 15 percent (i.e., 0.15) of the area in the West Region was deficient for an average duration of 4 months. The index of streamflow excess for the Northeast, Southeast, and Western Great Lakes Regions decreased sharply during December as streamflow in large parts of those regions returned to the normal range.

NORTHEAST

[Atlantic Provinces and Quebec; Delaware, Maryland, New York, New Jersey, Pennsylvania, and the New England States]

Streamflow generally decreased in New Brunswick, Quebec, Maine, Maryland, New Jersey, and throughout the central New England States. Flows were variable elsewhere in the region. Monthly mean flows remained in the above-normal range in parts of New York and Quebec and increased into that range in parts of Pennsylvania and Nova Scotia. Mean flow decreased into the below-normal range in parts of New Brunswick.

Ground-water levels generally declined and were near average. However, levels rose in parts of Connecticut, Massachusetts, and New York State, and were above average in parts of Connecticut, Massachusetts, and Maryland.

STREAMFLOW CONDITIONS

In southwestern Quebec, monthly mean discharge in Harricana River at Amos decreased seasonally, was 243 percent of median, and remained in the above-normal range for the 8th consecutive month as a result of high carryover flow from November. At the index station, Coulonge River near Fort Coulonge, the seasonal decrease in flow was only 7 percent compared to the normal decrease of 30 percent, and the resulting monthly mean flow was above the normal range. Also in southwestern Quebec, monthly mean discharge of St. Maurice River at Grand Mere increased, contrary to the normal seasonal pattern of decreasing flow, and was above the normal range at 224 percent of median. Elsewhere in the Province, mean flows decreased seasonally, were near or above median, and were in the normal range.

In southeastern New Brunswick, mean flow in Lepreau River at Lepreau decreased sharply to only 54

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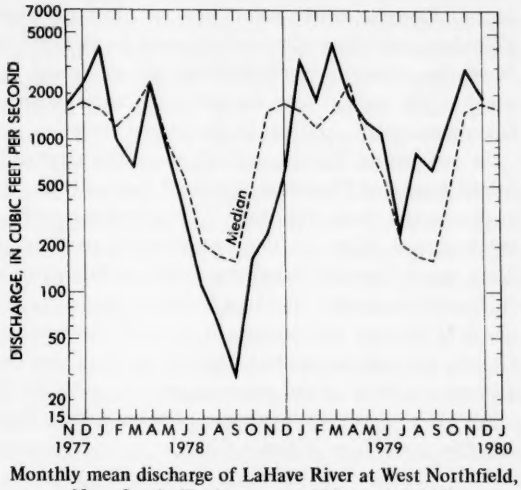
percent of median and was below the normal range for the first time since December 1978. In the northern part of the Province, monthly mean discharge of Upsalquitch River at Upsalquitch decreased seasonally and remained in the normal range for the 3d consecutive month.

In extreme northern Nova Scotia, mean flow in Northeast Margaree River at Margaree Valley increased 66 percent, contrary to the normal seasonal decrease of 21 percent from November to December, was more than twice the median flow for December and was above the normal range. In the southern part of the Province and typical of the trend in streamflow throughout most of the Northeast Region, mean flow of LaHave River at West Northfield decreased from the above-normal flows of prior months and was within the normal range for the first time since July 1979. (See graph.)



Monthly mean discharge of LaHave River at West Northfield, Nova Scotia (Drainage area, 484 sq mi; 1,254)

In Maine, Vermont, and New Hampshire, monthly mean flows at index stations decreased seasonally, were near or slightly above median, but were within the normal range.

In central Massachusetts, where mean flow in Ware River at Intake Works near Barre was above the normal range for the 5-month period, July through November 1979, flow decreased to 114 percent of the December median and was within the normal range.

In western Connecticut, monthly mean flows at index stations increased seasonally and averaged about 110 percent of median and were in the normal range. In the eastern part of the State and adjacent areas of Rhode Island, mean flows decreased, contrary to the normal seasonal pattern of increasing flows, in Branch River at Forestdale, R.I., Mount Hope River near Warrenville, Conn., and Salmon River near East Hampton, Conn., and was within the normal range at all three index stations, following 4 consecutive months of flow in the above-normal range.

In eastern New York, monthly mean discharge in Hudson River at Hadley decreased but because of high carryover flow from November, remained in the above-normal range for the 4th consecutive month. Similarly, in northern New York, mean flow of West Branch Oswegatchie River near Harrisville increased slightly and remained in the above-normal range for the 4th consecutive month. Elsewhere in the State, mean flows decreased and were below median but within the normal range.

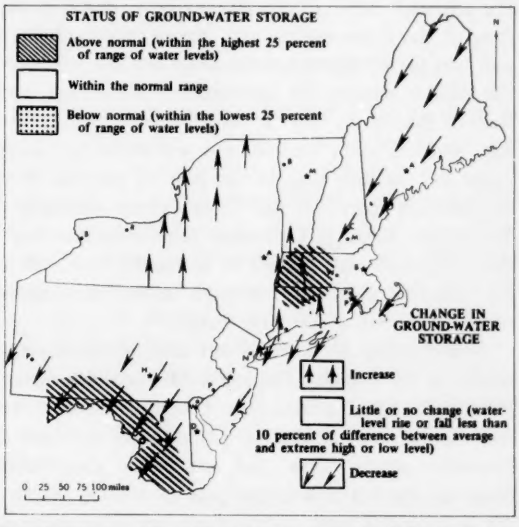
In western Pennsylvania, monthly mean discharge of Allegheny River at Natrona increased seasonally, was 168 percent of the December median flow and was above the normal range. In the remainder of the State, mean flows at index stations were generally above median but within the normal range.

In Delaware, Maryland, and New Jersey, monthly mean flows decreased at all index stations, contrary to the normal seasonal pattern of increasing flows, were generally above median, and within the normal range throughout the tristate area.

Monthly mean flow of Potomac River near Washington, D.C., decreased but because of high carryover flow from November and increased runoff from rains near end of December, remained in the above-normal range for the 4th consecutive month.

GROUND-WATER CONDITIONS

Ground-water levels declined, at least slightly, in most of the region. However, levels rose in parts of central New York State and also in some western parts of Connecticut and Massachusetts. (See map.) Levels were near average except above-average levels occurred in some wells in Massachusetts, Connecticut, and Maryland.



Map shows ground-water storage near end of December and change in ground-water storage from end of November to end of December.

SOUTHEAST

[Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia]

Streamflow increased seasonally in Kentucky, decreased in North Carolina, South Carolina, Virginia, and West Virginia, and was variable elsewhere in the region. Monthly mean discharge remained in the above-normal range in parts of Alabama, Kentucky, Mississippi, South Carolina, Tennessee, and Virginia. Mean flows were above the normal range for the 4th consecutive month in parts of Alabama and South Carolina, for the 5th consecutive month in parts of Kentucky, and for the 9th consecutive month in parts of Mississippi and Tennessee. Minor flooding was reported in parts of Kentucky and Mississippi.

Ground-water levels declined in Virginia and Alabama, and rose in Kentucky, North Carolina, and Mississippi. Trends were mixed in West Virginia, Georgia, and Florida. New December high levels were recorded in Kentucky, Virginia, and North Carolina, and a new alltime high was reached in Kentucky.

STREAMFLOW CONDITIONS

In Pearl River basin in central and southern Mississippi, high carryover flow from November, augmented by increased runoff from rains early in December, resulted in minor flooding along Pearl River floodplain. In the adjacent basin of Big Black River, monthly mean flow at the index station near Bovina increased sharply and was in the above-normal range for the 5th time in the past 6 months. In southeastern Mississippi, mean flow of Pascagoula River at Merrill also increased seasonally, was 2½ times median, and was above the normal range for the l0th time in the past 12 months. In the northeastern part of the State, mean discharge of Tombigbee River at Columbus decreased, contrary to the normal seasonal pattern of increasing flow, but was 2½ times median and remained in the above-normal range for the 9th consecutive month.

Downstream, in the adjacent area of northwestern Alabama, the monthly mean flow of Tombigbee River at Demopolis lock and dam, near Coatopa decreased, contrary to the normal seasonal pattern, was 1½ times the December median flow, and was in the above-normal range for the 9th time in the past 11 months. In northern and central parts of the State, monthly mean discharge of Paint Rock River near Woodville and Cahaba River at Centreville, respectively, also decreased, contrary to the normal seasonal pattern of increasing flows, were less than their respective median discharges for December, and were in the normal range. Monthly mean flows had been in the above-normal range for 6 consecutive months at each of these stations.

In Georgia, monthly mean flows were variable and were in the normal range. For example, in the eastern and southern parts of the State, respectively, mean flows of Altamaha River at Doctortown and Alapaha River at Statenville increased seasonally but were in the normal range, in contrast to the above-normal flows that persisted at both stations in November. In the extreme northern part of the State, mean discharge of Etowah River at Canton decreased, contrary to the normal seasonal pattern, and was in the normal range. In west-central Georgia, where mean flow of Flint River near Culloden was above the normal range in October and November, monthly mean discharge also decreased, contrary to the normal seasonal pattern, was less than the December median, and was in the normal range.

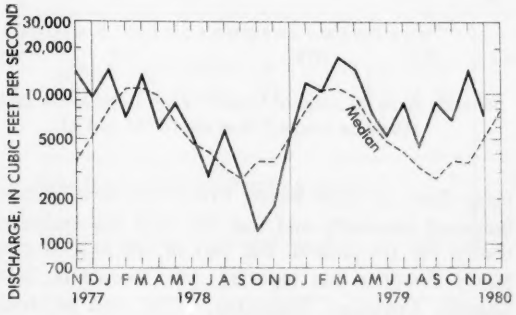
In east-central Florida, monthly mean discharge of St. Johns River near Christmas decreased seasonally and was in the normal range, following 3 consecutive months of above-normal flow. In the south-central part of the State, mean flow of Fisheating Creek at Palmdale also decreased seasonally, remained in the normal range, and was 179 percent of median. In extreme northwestern Florida, monthly mean discharge of Econfina Creek near Bennett remained in the above-normal range for the 9th consecutive month. In the west-central part of the State, monthly mean flow of Peace River at Arcadia increased slightly, contrary to the normal seasonal pattern, but remained within the normal range.

Streamflow decreased in all parts of South Carolina, contrary to the normal seasonal pattern of increasing flow. For example, in the Inner Coastal Plain, where monthly mean discharge of North Fork Edisto River at Orangeburg was in the above-normal range in 6 of the past 7 months, mean flow decreased, in contrast to the normal seasonal increase in flow, and was in the normal range. In the northeastern part of the State, monthly mean flow of Lynches River at Effingham also decreased, contrary to the normal seasonal pattern, and was in the normal range, following 2 months of mean discharge in the above-normal range. In the adjacent basin of Pee Dee River, mean flow at Peedee also decreased, in contrast to the usual increase in flow, but remained in the above-normal range for the 4th consecutive month.

Streamflow decreased in all parts of North Carolina, also contrary to the normal seasonal pattern. In the extreme western part of the State, where monthly mean

discharge of French Broad River at Asheville was in the above-normal range in 10 of the past 12 months, mean discharge decreased and was in the normal range, but was 1½ times the median flow for December. In the west-central Piedmont, where mean flow of Yadkin River near Mocksville was above the normal range in 9 of the past 12 months, monthly mean discharge also decreased into the normal range but was slightly greater than median. In the eastern Piedmont and Coastal Plain, monthly mean flows of Cape Fear River at William O. Huske Lock near Tarheel and Neuse River near Clayton also decreased into the normal range, from the above-normal range, and were, respectively, slightly greater than, and slightly less than median.

In western Tennessee, monthly mean flow of Buffalo River near Lobelville increased seasonally and remained in the above-normal range for the 9th consecutive month as a result of high carryover flow from November, augmented by increased runoff near monthend. In the north-central part of the State, mean discharge of Harpeth River near Kingston Springs decreased but was above the normal range for the 8th time in the past 9 months as a result of high carryover flow from November, augmented by increased runoff near midmonth. In eastern Tennessee, monthly mean discharge of Emory River at Oakdale also decreased, contrary to the normal seasonal pattern, and was in the normal range after 8 consecutive months of above-normal flow. Also in eastern Tennessee, mean flow of French Broad River below Douglas Dam decreased, in contrast to the normal seasonal pattern, and was within the normal range, following 3 consecutive months of flow in the above-normal range. (See graph.)



Monthly mean discharge of French Broad River below Douglas Dam, Tenn. (Drainage area, 4,543 sq mi; 11,770 sq km)

In northern Kentucky, monthly mean flow of Licking River at Catawba increased seasonally, but was in the normal range, following 6 consecutive months of above-normal flow. In the southern part of the State, mean discharge of Green River at Munfordville increased seasonally and remained in the above-normal range for the 5th consecutive month. Minor flooding was reported to have occurred in parts of both the Green and Licking River basins near midmonth.

In West Virginia, mean flows decreased in all parts of the State, contrary to the normal seasonal pattern of increasing flows, and were in the normal range. For example, in the southwestern part of the State, where mean discharge of Kanawha River at Kanawha Falls was above the normal range in 8 of the preceding 9 months, mean flow decreased into the normal range and was only slightly greater than median. In eastern West Virginia, monthly mean discharge of Greenbrier River at Alderson also decreased into the normal range, following 4 consecutive months of above-normal flows, and in extreme northern West Virginia, mean flow of Potomac River at Paw Paw also decreased into the normal range, following 3 consecutive months of flows in the above-normal range.

In Virginia, monthly mean flows also decreased in all parts of the State, contrary to the normal seasonal pattern. In the southeastern part of the State, where mean discharge of Nottaway River near Stony Creek was above the normal range for 11 consecutive months prior to November, mean flow was 191 percent of the December median and was in the above-normal range. In northern Virginia, mean flow of Rapidan River near Culpeper continued to decrease and was in the normal range. In the central part of the State, monthly mean flow of Slate River near Arvonia also continued to decrease, was slightly less than the median for December, and remained in the normal range.

GROUND-WATER CONDITIONS

In West Virginia, levels declined in the northern and eastern panhandles, and rose elsewhere. Levels were above average in a few counties in the central part of the State and in the two extreme eastern counties; they were below average elsewhere.

In Kentucky, levels generally rose and were above average statewide. A new December high level was reached in the artesian well in Viola, Graves County—in the Jackson Purchase Region—in 29 years of record. A new alltime high level was reached in the shallow water-table observation well in glacial outwash sand and gravel in Louisville, in Jefferson County, in 34 years of record.

In Virginia, levels declined but continued above average. A new December high was recorded in the observation well in northern Virginia in 22 years of record.

In western Tennessee, the artesian level in the key well in the "500-foot sand" near Memphis rose slightly but continued 15 feet below average.

In North Carolina, levels rose and were above long-term averages across the entire State. A new December high was reached in the shallow well in granite at Chapel Hill in the Piedmont, in 45 years of record.

Levels rose statewide in Mississippi. Levels were above average in the shallow water-table wells, but were slightly below average in the deeper artesian wells.

In Alabama, levels declined and were below average.

In Georgia, levels in the Piedmont held fairly steady. In the coastal counties, levels in the principal artesian aquifer also held steady. Levels in the water-table aquifer were above average. In the southwest, levels declined as much as 7 feet.

In Florida, levels declined less than 1 foot in the extreme northwest and in the central peninsula. In west-central Florida, levels rose from less than 1 foot to nearly 2 feet. End-of-month levels ranged from 4.4 feet below average in the Floridan aquifer at Jacksonville to 4.8 feet above average in the sand and gravel aquifer at Pensacola. In southeast Florida, levels declined less than half a foot in Palm Beach and St. Lucie Counties and showed very little change during the month for the rest of southern Florida. Levels were about half a foot above average.

WESTERN GREAT LAKES REGION

[Ontario; Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin]

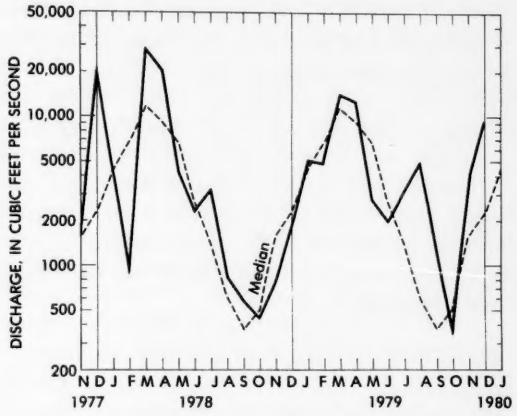
Streamflow generally increased in Illinois, Indiana, and Ohio, in the southern part of the region, but generally decreased in Ontario, Michigan, Minnesota, and Wisconsin, in the northern part. Monthly mean flows remained in the above-normal range in parts of Ontario, Indiana, Minnesota, and Ohio, and increased into that range in parts of Illinois. Monthly mean discharges were highest of record for the month in parts of Minnesota. Flooding occurred in Illinois, Indiana, Ohio, and Ontario.

Ground-water levels declined in Wisconsin and Ohio, changed little in Indiana, and showed mixed trends in Minnesota and Michigan. Above-normal levels generally prevailed.

STREAMFLOW CONDITIONS

In southwestern Indiana, flooding that was in progress in the lower parts of the Wabash and White River basins at the end of November continued into the first few days of December. Minor flooding was reported again in the same area December 21–24, as a result of rapid runoff from rainfall during that period and the high carryover flow from the previous flooding. Monthly mean flows of Wabash River at Mount Carmel, Ill., and East Fork White River at Shoals increased sharply, remained above the normal range for the 6th consecutive month, and were 3 and 5 times their respective December medians. In northeastern Indiana, mean discharge of Mississinewa River at Marion decreased, contrary to the normal seasonal pattern of increasing flow, but remained in the above-normal range and was 3½ times median.

In central Ohio, monthly mean discharge of Scioto River at Higby decreased slightly, in contrast to the normal seasonal pattern, but was 475 percent of the December median flow, and remained above the normal range for the 5th consecutive month. In the northwestern part of the State, mean discharge of Maumee River at Waterville increased sharply, was 4 times median, and was above the normal range for the 5th time in the past 6 months. (See graph.) In northeastern Ohio, monthly



Monthly mean discharge of Maumee River at Waterville, Ohio (Drainage area, 6,330 sq mi; 16,395 sq km)

mean flow of Little Beaver Creek near East Liverpool increased seasonally and was 2½ times the median discharge for the month, but was in the normal range. Minor flooding was reported near monthend in the Chagrin, Cuyahoga, Mahoning, Tiffin, and St. Joseph River basins in this part of the State.

In Michigan's Upper Peninsula, where monthly mean discharge of Sturgeon River near Sidnaw was in the above-normal range in October and November, mean flow decreased sharply as a result of freezing temperatures, and was in the normal range. In the Lower Peninsula, monthly mean discharges were variable, increasing

(Continued on page 8.)

SELECTED DATA FOR THE GREAT LAKES, GREAT SALT LAKE, AND OTHER HYDROLOGIC SITES

GREAT LAKES LEVELS

Water levels are expressed as elevations in feet above International Great Lakes Datum 1955

(Data furnished by National Ocean Survey, NOAA, via U.S. Army Corps of Engineers office in Detroit. To convert data to elevations above mean sea level datum of 1929, add the following values: Superior, 0.96; Michigan-Huron, 1.20; St. Clair, 1.24; Erie, 1.57; Ontario, 1.22.)

Lake	December 31, 1979	Monthly mean, December		December		
		1979	1978	Average 1900–75	Maximum (year)	Minimum (year)
Superior (Marquette, Mich.)	600.81	600.93	600.37	600.60	601.53 (1974)	598.94 (1925)
Michigan and Huron (Harbor Beach, Mich.)	579.34	579.37	578.52	577.88	579.97 (1973)	575.40 (1964)
St. Clair (St. Clair Shores, Mich.)	574.96	574.57	573.61	572.93	575.21 (1972)	571.05 (1925)
Erie (Cleveland, Ohio)	571.88	571.51	570.47	569.78	572.35 (1972)	567.53 (1934)
Ontario (Oswego, N.Y.)	244.22	244.14	243.71	243.98	246.19 (1945)	241.48 (1934)

GREAT SALT LAKE

Alltime high: 4,211.6 (1873). Alltime low: 4,191.35 (October 1963).	December 31, 1979	December 31, 1978	Reference period 1904–78		
			December average, 1904–78	December maximum (year)	December minimum (year)
Elevation in feet above mean sea level:	4,197.70	4,198.65	4,197.90	4,204.20 (1923)	4,191.85 (1963)

LAKE CHAMPLAIN, AT ROUSES POINT, N.Y.

Alltime high (1827–1977): 102.1 (1869). Alltime low (1939–1977): 92.17 (1941).	December 31, 1979	December 31, 1978	Reference period 1939–78		
			December average, 1939–78	December max. daily (year)	December min. daily (year)
Elevation in feet above mean sea level:	96.04	94.10	95.26	98.30 (1973)	93.25 (1953)

FLORIDA

Site	December 1979		November 1979	December 1978
	Discharge in cfs	Percent of normal	Discharge in cfs	Discharge in cfs
Silver Springs near Ocala (northern Florida)	945	117	955	780
Miami Canal at Miami (southeastern Florida)	135	53	230	312
Tamiami Canal outlets, 40-mile bend to Monroe	334	596	334	58

(Continued from page 6.)
in Red Cedar River at East Lansing and decreasing in Muskegon River at Evart, but remaining in the normal range at each station. Monthly mean level of Houghton Lake near Houghton Lake Heights was above normal for the month, but levels of Crooked Lake near Conway and Lake Mitchell-Cadillac at Cadillac were below normal.

In southeastern Ontario, monthly mean flow of Saugeen River at Port Elgin continued to increase seasonally and was in the above-normal range. Flooding was reported to have occurred in this part of the Province December 24–26. Elsewhere in Ontario, mean discharges decreased seasonally, were slightly greater than median, and were in the normal range.

In extreme northern Minnesota, in Lake of the Woods basin, mean flow of Rainy River at Manitou Rapids remained the same as in November and continued within the normal range. In the west-central part of the State, monthly mean discharge of Buffalo River near Dilworth decreased seasonally and was in the normal range, but was 1½ times the December median discharge. In southwestern Minnesota, mean flow of Minnesota River near Jordan continued to decrease seasonally but remained in the above-normal range for the 6th consecutive month as a result of high carryover flow from November, and was 6 times the December median discharge. Also, in the adjacent basin of Des Moines River, the monthly mean discharge of 800 cfs in Des Moines River at Jackson (drainage area, 1,220 square miles) was highest for December since records began in 1936, as a result of high carryover flow from November. In the central part of the State, monthly mean flow of Crow River at Rockford decreased seasonally but remained in the above-normal range as a result of high carryover flow from November.

In north-central Wisconsin, mean flow of Oconto River near Gillett decreased seasonally but remained in the above-normal range for the 9th time in the past 10 months. In the central and northwestern parts of the State, monthly mean flows of Wisconsin River at Muscoda and Jump River at Sheldon, respectively, also decreased seasonally but were above the normal range as a result of increased runoff early in the month. Elsewhere in the State, mean flows were variable but remained in the normal range.

In extreme southeastern Illinois, where flooding occurred along the Wabash River, on the Illinois-Indiana border, during the latter part of November and early December, minor flooding was reported again December 21–24. In northern Illinois, monthly mean discharge of Rock River near Joslin increased sharply, was 2 times median, and was in the above-normal range. In the tributary basin of Pecatonica River, mean discharge at the index station at Freeport decreased slightly but was in the above-normal range. In central and southern parts of the State, mean discharges increased seasonally but remained within the normal range.

GROUND-WATER CONDITIONS

Levels in shallow water-table wells in Minnesota rose and continued above average in the southern part of the State, and declined but continued above average in the north. In the Minneapolis-St. Paul area, artesian levels continued to rise and continued above average in both principal aquifers.

In Wisconsin, levels declined slightly, statewide, but nevertheless were above average.

In Michigan, levels declined and were below average in the southern part of the Lower Peninsula. Elsewhere, levels rose and were near or above average.

In Illinois, the level in the shallow well in glacial drift at Princeton, Bureau County, rose nearly a foot and continued above average by more than 3 feet.

In Indiana, levels changed little, and continued well above average.

Levels declined in Ohio, but were average in the northeast and continued above average in the central part of the State.

MIDCONTINENT

[Manitoba and Saskatchewan; Arkansas, Iowa, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas]

Streamflow increased seasonally in Arkansas, Louisiana, Texas, and Saskatchewan, decreased in Manitoba, Iowa, Kansas, Missouri, and South Dakota, and was variable elsewhere in the region. Monthly mean flows remained in the above-normal range in parts of Arkansas, Iowa, Kansas, Louisiana, Nebraska, North Dakota, and South Dakota. Mean flows remained in the below-normal range in parts of Nebraska, and decreased into that range in parts of Kansas. Monthly and daily mean discharges were highest of record for the month in parts of South Dakota, and monthly mean discharge was highest for the month in parts of Iowa. Flooding occurred in parts of Louisiana.

Ground-water levels rose in Nebraska, Iowa, and Arkansas; trends were mixed in other States. Levels were above average in North Dakota and Iowa, and below average in Kansas and Arkansas; levels were above and below average in other States. A new high level for December was reached in Nebraska, and a new December low occurred in Texas.

STREAMFLOW CONDITIONS

In the Pearl River basin, in southeastern Louisiana and the adjacent area of southern Mississippi, monthly mean discharge of Pearl River near Bogalusa, La. increased sharply, was 5 times median, and remained in the above-normal range for the 12th consecutive month. Stages at that station were reported to have been above the National Weather Service designated flood stage of 15 feet during the entire month. In the south-central part of the State, mean discharge of Calcasieu River near Oberlin increased seasonally, was 3½ times median, and remained above the normal range for the 6th consecutive month. Elsewhere in the State, monthly mean flows increased seasonally, but were within the normal range.

In southern Arkansas, monthly mean flow of Saline River near Rye increased seasonally, was 3 times median, and remained in the above-normal range. In northern Arkansas, mean discharge of Buffalo River near St. Joe continued to increase seasonally, was 175 percent of median, and remained in the normal range.

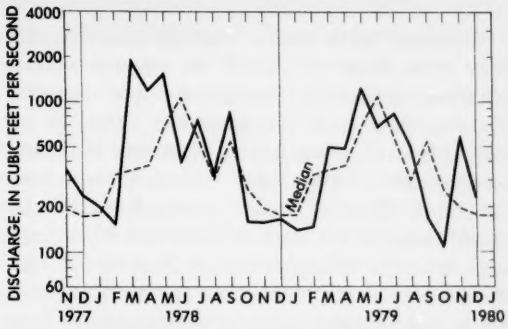
In eastern Texas, monthly mean discharge of Neches River near Rockland increased seasonally and was 3 times the December median flow but was in the normal range. In the central part of the State, mean flow of Guadalupe River near Spring Branch remained in the normal range and was essentially the same as the mean flows that occurred during October and November. In northern Texas, mean discharges were reported to have been below the normal range. Records from 38 reservoirs in the State showed that storage decreased in 24, increased in 12, and remained the same in 2.

In southwestern Oklahoma, mean flow of Washita River near Durwood decreased seasonally and was less than median but remained within the normal range. Similar streamflow conditions were reported to have persisted in other parts of the State.

In Missouri, monthly mean flows at index stations in northern and southern parts of the State decreased, contrary to the normal seasonal pattern of increasing flows, and remained within the normal range.

In northwestern Kansas, mean discharge of Saline River near Russell decreased seasonally, was only 36 percent of median, and was below the normal range. In the north-central part of the State, monthly mean flow of Little Blue River near Barnes also decreased seasonally, but remained in the above-normal range as a result of high carryover flow from November. (See graph.) Similarly, in southern Kansas, mean discharge of Arkansas River at Arkansas City decreased seasonally but remained in the above-normal range.

In southwestern Iowa, monthly mean flow of Nishnabotna River above Hamburg decreased seasonally



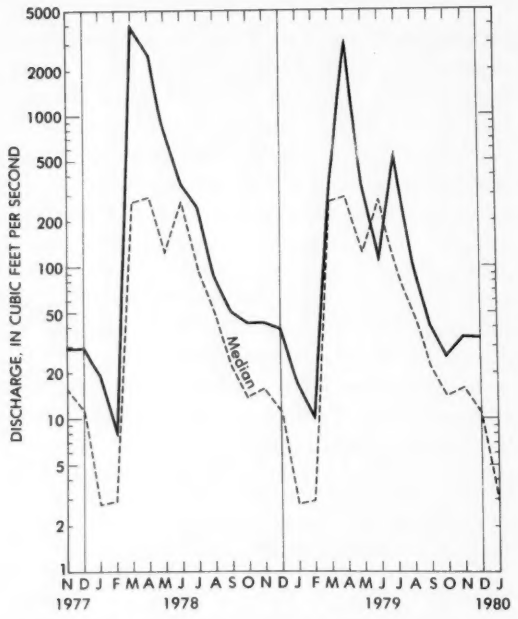
Monthly mean discharge of Little Blue River near Barnes, Kans. (Drainage area, 3,324 sq mi; 8,609 sq km)

but continued to be 3 times median and remained in the above-normal range. In north-central Iowa, where the monthly mean discharge of 4,110 cfs in Des Moines River at Fort Dodge (drainage area, 4,190 square miles) was highest for the month in November, the December mean discharge of 2,578 cfs was highest of record for the month of December, and the daily mean discharge of 3,620 cfs on December 18 was only 5 percent less than the maximum daily mean of record for the month. In eastern Iowa, mean flow of Cedar River at Cedar Rapids also decreased seasonally, was 3½ times median, and remained in the above-normal range.

In northeastern Nebraska, monthly mean discharge of Elkhorn River at Waterloo increased slightly, contrary to the normal seasonal pattern of decreasing flow, was 213 percent of the December median discharge, and remained above the normal range. Streamflow in the north-central part of the State also was reported to be above the normal range. In the northwestern part of the State, mean flow of Niobrara River above Box Butte Reservoir decreased, contrary to the normal seasonal pattern of increasing flow, was only 54 percent of median, and remained in the below-normal range. In the Nebraska Panhandle, monthly mean discharges in the North Platte River basin were in the normal range. Unregulated flows of streams in the Republican River basin, in southwestern Nebraska, were reported to be between 70 and 100 percent of normal.

In the Big Sioux River basin, in eastern South Dakota and the adjacent areas of Minnesota and Iowa, mean flow of Big Sioux River at Akron, Iowa (drainage area, 9,030 square miles) decreased seasonally but was 10 times median and remained in the above-normal range for the 5th consecutive month. The monthly mean discharge of 1,390 cfs, and the daily mean of 2,000 cfs on December 8, were highest for December since records began in October 1928. This was the 2d consecutive month of record-high monthly and daily mean discharges at this station.

In eastern North Dakota, monthly mean flow of Red River of the North at Grand Forks decreased seasonally but remained above the normal range, as a result of high carryover flow from November and inflow of water released from storage in lakes in Minnesota. In the southwestern part of the State, monthly mean flow of Cannonball River at Breien remained in the above-normal range for the 8th time in the past 9 months, and was 3 times the December median discharge, as a result of extremely mild temperatures and a continued high rate of ground-water inflow to the stream. (See graph.) Ice jams on the Missouri River during midmonth resulted



Monthly mean discharge of Cannonball River at Breien, N. Dak. (Drainage area, 4,100 sq mi; 10,600 sq km)

in the highest stage recorded at the Bismarck gaging station since completion of Garrison Dam in 1953.

In southeastern Saskatchewan, monthly mean flow of Qu'Appelle River near Lumsden increased seasonally, as a result of increased runoff near monthend, and remained in the normal range.

In southern Manitoba, mean discharge of Waterhen River below Waterhen Lake continued to decrease seasonally and remained in the normal range. The level of Lake Winnipeg at Gimli averaged 713.56 feet above mean sea level for the month, 0.42 foot lower than last month, 0.53 foot lower than last December, 0.47 foot higher than the long-term mean for December, 2.45 feet lower than the maximum average level for December (occurred in 1927), and 3.84 feet higher than the minimum average level for the month (occurred in 1940). Records of Lake Winnipeg levels were started in May 1913 at Winnipeg Beach.

GROUND-WATER CONDITIONS

In North Dakota, levels changed very little; they rose slightly in the west and declined less than a foot in the east. Levels in the key wells were slightly above average.

In Nebraska, rising levels prevailed, reflecting seasonal recovery from irrigation withdrawals, although levels in some shallow observation wells showed net declines. Levels were near or slightly above long-term averages. The water-table well in Blaine County rose about a half a foot, reaching a new December high in 45 years of record.

Levels in shallow water-table wells rose statewide and ranged from slightly above average in southeastern Iowa to well above average in the northern and western parts of the State.

Mixed trends prevailed in Kansas, although changes were only about a foot or less; levels were below average.

In the rice-growing area of east-central Arkansas, the level in the shallow Quaternary aquifer rose slightly, but was more than 6 feet below average. The level in the deep aquifer—the Sparta Sand—rose about 6½ feet, and was 18 feet below average. In the industrial aquifer of central and southern Arkansas—also the Sparta Sand—the level in the key well at Pine Bluff rose 4 feet and was 28 feet below average.

In Louisiana, levels in the Miocene and Sparta Sand aquifers in the north continued to decline. Levels in the Wilcox, Cockfield, and Terrace aquifers, and in the alluvial aquifers of the Mississippi and Red Rivers, rose seasonally. In the southwest, levels continued to recover, although levels fluctuated within 2 feet of last month's levels in the "500-foot" and "700-foot" sands of the Lake Charles industrial area. Levels in most wells in the southeastern part of the State reflected normal seasonal rises, although levels declined in the "1,500-foot sand" in the Bogalusa area.

In Texas, levels in the Edwards aquifer declined at Austin and were unchanged at San Antonio; levels continued above average. Levels rose in the Evangeline aquifer at Houston, but were below average. Levels declined and were below average in the bolson deposits at El Paso. The level in the observation well at El Paso again reached a new December low in 22 years of record.

WEST

[Alberta and British Columbia; Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming]

Streamflow increased seasonally in Nevada, Oregon, and Washington, decreased seasonally in Alberta,

Colorado, and Wyoming, and was variable elsewhere in the region. Monthly mean flows remained in the below-normal range in parts of Alberta, Arizona, British Columbia, Idaho, Montana, New Mexico, Utah, and Washington. Above-normal streamflow persisted in parts of Colorado and New Mexico and increased into that range in parts of Washington. Flooding occurred in Washington.

Ground-water levels rose in Nevada and Arizona, and rose in most of the key wells in New Mexico, and declined or held steady in Montana and southern California. Trends were mixed in other States in the region. New December high levels occurred in southern California and Utah, and new December lows were reached in Idaho, Nevada, Utah, Arizona, and New Mexico.

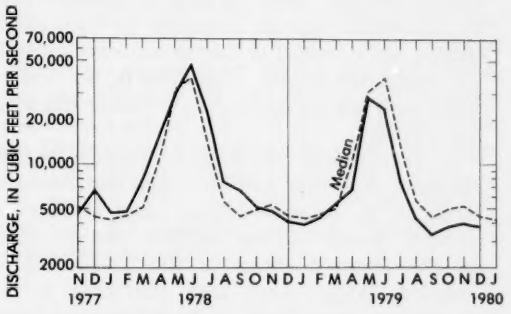
STREAMFLOW CONDITIONS

In northwestern Washington, severe flooding occurred during the period December 14–18 on the Olympic Peninsula and on the western slopes of the Cascade Mountains from Seattle to the Washington-Canadian boundary. The flooding was the result of run-off from intense rainfall and was described by the National Weather Service as being one of the wettest Decembers on record in the Seattle area. Two deaths were attributed to the flooding. On the west side of the Olympic Peninsula, a peak discharge of approximately 30,000 cfs (equal to that of a 50-year flood) occurred at the gaging station, Bogachiel River near Forks (drainage area, 111 square miles) on December 15, and a peak discharge of 28,000 cfs (also equal to that of a 50-year flood) occurred December 15 on Calawah River near Forks (drainage area, 129 square miles). In the northern part of the Olympic Peninsula, the peak discharge of 25,000 cfs (equal to that of a 25-year flood) occurred December 17 at Elwha River at McDonald Bridge, near Port Angeles (drainage area, 269 square miles). Recurrence intervals of flood discharges on streams draining the western slopes of the Cascade Mountains generally ranged from 5 to 10 years. At Skykomish River near Gold Bar, where monthly mean flow had been below the normal range and only 25 percent of median during November, mean flow increased sharply to 223 percent of median in December and was above the normal range for the first time since March 1979. By contrast, monthly mean flow of Spokane River at Spokane, in eastern Washington, increased seasonally but remained in the below-normal range for the 7th consecutive month.

In northwestern British Columbia, monthly mean flow of Skeena River at Usk continued to decrease seasonally and remained in the below-normal range for the 2d consecutive month. In the southern part of the Province, where mean flow at Fraser River at Hope had been below the normal range for 4 consecutive months, through November, flow increased to 79 percent of median and was in the normal range in December.

In southwestern Alberta, streamflow decreased seasonally in Bow River at Banff and was in the normal range, following 4 consecutive months of flow in the below-normal range. In the western part of the Province, monthly mean discharge of Athabasca River at Hinton also decreased seasonally but remained in the below-normal range for the 7th time in the past 8 months.

In southeastern Idaho, monthly mean discharge of Snake River near Heise decreased seasonally and remained in the below-normal range for the 7th consecutive month. Downstream, at Weiser, mean flow of the Snake River was in the below-normal range for the 7th time in the past 8 months. Similarly, in north-central Idaho, mean flow of Salmon River at White Bird decreased seasonally, was 86 percent of median, and remained in the below-normal range for the 7th consecutive month. (See graph.) Elsewhere in the State,



Monthly mean discharge of Salmon River at White Bird, Idaho
(Drainage area, 13,550 sq mi; 35,090 sq km)

monthly mean flows in the Clearwater, Coeur d'Alene, Weiser, and Kootenai Rivers were in the normal range, following at least 2 consecutive months of flow in the below-normal range. Reservoir storage for irrigation increased but remained below-average.

West of the Continental Divide in western Montana, monthly mean flow of Clark Fork at St. Regis increased to 75 percent of median but remained in the below-normal range for the 7th consecutive month. In the southwestern part of the State, mean flow of Yellowstone River at Corwin Springs continued to decrease seasonally but remained in the below-normal range for the 6th consecutive month and was 84 percent of median. Elsewhere in the State, monthly mean flows at

index stations generally increased from the below-normal flows of previous months and streamflow was within the normal range.

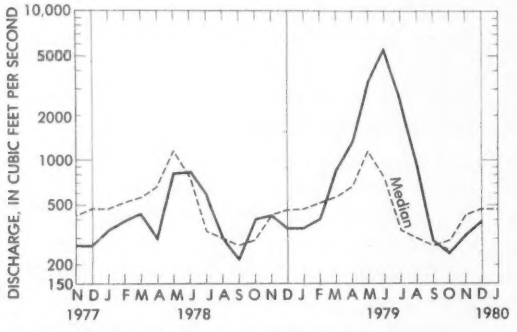
In northern Wyoming, monthly mean discharge of Tongue River near Dayton continued to decrease seasonally and remained in the normal range for the 3d consecutive month. In the southern part of the State, mean flow of North Platte River above Seminoe Reservoir, near Sinclair decreased seasonally and was within the normal range.

In Utah, flows generally decreased seasonally and were below the normal range except at index stations on Big Cottonwood Creek near Salt Lake City, Beaver River near Beaver, and Colorado River near Cisco, which were 87, 101, and 97 percent of median, respectively. In the northeastern part of the State, monthly mean flows of Weber River near Oakley and Whiterocks River near Whiterocks remained in the below-normal range for 4 and 5 consecutive months, respectively. In the southeastern part of the State, mean flow of San Juan River near Bluff decreased seasonally to 61 percent of median and remained in the below-normal range for the 4th consecutive month.

Contents of the Colorado River Storage Project decreased 496,420 acre-feet during the month.

In west-central Colorado, west of the Continental Divide, monthly mean discharge of Roaring Fork River at Glenwood Springs decreased to 137 percent of median but remained in the above-normal range for the 2d consecutive month. Elsewhere in the State, mean flows were near or slightly above median but within the normal range.

In southeastern New Mexico, monthly mean flow of Delaware River near Red Bluff increased seasonally and remained in the above-normal range for the 2d consecutive month. In the northern part of the State, monthly mean discharge of Rio Grande below Taos Junction Bridge, near Taos continued to increase seasonally but remained in the below-normal range for the 3d consecutive month and was only 84 percent of the December median discharge. (See graph.) Elsewhere in the State, flows at index stations were within the normal range.



Monthly mean discharge of Rio Grande below Taos Junction Bridge, near Taos, N. Mex. (Drainage area, 9,730 sq mi; 25,200 sq km)

In southern Arizona, monthly mean flow of San Pedro River at Charleston continued to increase seasonally but was below the normal range for the 5th time in the past 6 months. In the northern part of the State, no flow was observed in Little Colorado River near Cameron during the entire month. Elsewhere in the State, monthly mean flows at index stations were below-median but within the normal range.

In north-central Nevada, streamflow in Humboldt River at Palisade increased seasonally and remained in the normal range.

In California, streamflow decreased, contrary to the normal seasonal pattern of increasing flows, and was generally within the normal range. However, on the Sierra Nevada west slope in northern California, monthly mean discharge of North Fork American River at North Fork Dam decreased to only 37 percent of the December median and was below the normal range for the first time since December of 1978. Combined contents of 10 major reservoirs in northern California were 105 percent of average and 95 percent of the contents a year ago.

In Oregon, monthly mean flows at all index stations increased seasonally and were generally less than median but within the normal range throughout the State.

GROUND-WATER CONDITIONS

In Washington, the level in the water-table well in eastern Washington at Spokane declined nearly 2 feet and was more than 3 feet below average. The level in the artesian well in the Puget Trough area, in western Washington, rose more than half a foot and continued above average—this month, by more than 3½ feet.

The level in the well penetrating the sand and gravel aquifer in the Boise Valley continued to decline but was again slightly above average. Although trends were mixed, water levels in the key wells representative of the Snake River Plain aquifer showed little or no net change. New December lows were recorded among these wells, in the eastern, south-central, and southwestern parts of the Plain, in 30, 29, and 22 years of record, respectively. The level in the key well in the western part rose slightly but was nearly 4 feet below average. The level in the well representative of the alluvial aquifer underlying the Rathdrum Prairie, northern Idaho, declined less than a foot and continued below average by nearly 7 feet.

In Montana, the level in the shallow observation well in alluvium, at Hamilton Fairgrounds, declined more than 1½ feet and continued slightly below average.

In southern California, the level in the key well in Los Angeles County in the San Gabriel River basin continued to decline and remained below average. In Orange County, in the Los Alamitos area, the level in the

key well held steady and was below average. In Santa Barbara County, the level in the key well in Santa Ynez Valley also showed no net change, and the level in the key well in Santa Maria Valley continued to decline; both continued well above average. Despite a decline of almost 1.5 feet, the level in the key well at Cuyama in the Upper Cuyama Valley was at a new December high in 29 years of record; this is the 7th consecutive month-end high at this well.

The level in the key well in Las Vegas Valley in Nevada rose 1¾ feet; even so, the level was at a new December low in 33 years of record. The level in the well at Truckee Meadows rose but continued below average. Levels in the wells at Steptoe Valley and Paradise Valley rose and continued above average.

In Utah, levels rose in the Flowell and Holladay areas, and continued below average. Despite the rise, the level was at a new December low in the Holladay well in 31 years of record. Levels declined in the Logan and Blanding areas, but were above average; the level in the Blanding well was at a new December high in 19 years of record.

Water levels in Arizona rose in the five principal observation wells. New low levels were recorded for December in two wells, despite the rises; one of these was in the well in the Elfrida area, with 29 years of record.

In New Mexico levels rose in three wells and declined in a fourth; all were below average. A new December low was recorded in the Dayton water-table well, in the southern part of the Roswell basin, in 42 years of record.

ALASKA

Streamflow decreased seasonally at all index stations in the State and remained in the above-normal range for the 3d consecutive month at Little Susitna River near Palmer (drainage area, 61.9 square miles) and Kenai River at Cooper Landing, in the south-central part of the State. The monthly mean discharge of 61.9 cfs at the index station on Little Susitna River was highest for December in 32 years of record. In southeast and interior Alaska, mean flows remained in the normal range and ranged from 90 percent of median at Chena River at Fairbanks to 148 percent of median at Gold Creek at Juneau.

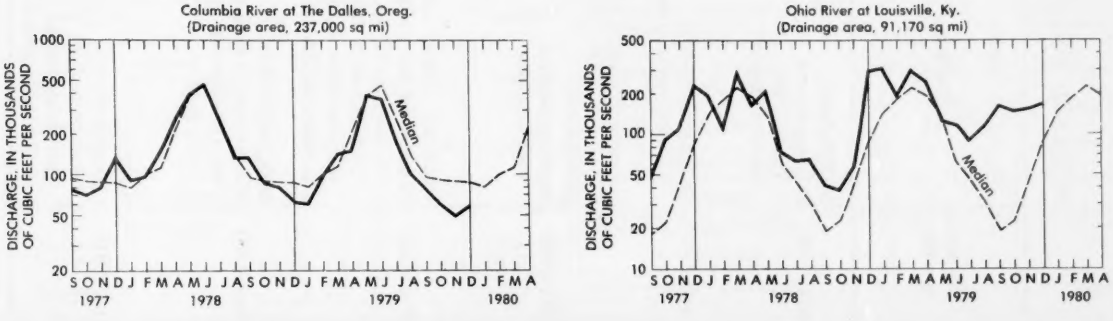
Ground-water levels in wells tapping confined aquifers in the Anchorage area rose less than one foot, except in the central area where pumping caused declines in some observation wells.

HAWAII

On the Island of Kauai, mean flow of East Branch of North Fork Wailua River near Lihue decreased into the below-normal range and was only 39 percent of median. Flow at this station also was below the normal range in October. On the Island of Maui, where monthly mean discharge of Honopou Stream near Huelo increased sharply into the above-normal range in November, mean flow decreased into the normal range and was less than the December median flow for that site. Runoff increased sharply near monthend in Kalihi Stream near Honolulu (Island of Oahu) but monthly mean discharge remained in the normal range. On the Island of Hawaii, monthly mean flow of Waiakea Stream near Mountain View decreased sharply and was only ½ the December median discharge, but remained within the normal range.

On Guam, Mariana Islands, monthly mean flow of Ylig River near Yona decreased seasonally but was greater than the December median discharge, and remained in the normal range.

HYDROGRAPHS OF TWO LARGE RIVERS



DISSOLVED SOLIDS AND WATER TEMPERATURES FOR DECEMBER AT DOWNSTREAM SITES ON SIX LARGE RIVERS

Station number	Station name	December data of following calendar years	Stream discharge during month	Dissolved-solids concentration during month[a]		Dissolved-solids discharge during month[a]			Water temperature during month[b]		
			Mean (cfs)	Minimum (mg/L)	Maximum (mg/L)	Mean	Minimum	Maximum	Mean, in °C	Minimum, in °C	Maximum, in °C
						(tons per day)					
	NORTHEAST										
01463500	Delaware River at	*1979	11,900	84	106	2,770	2,150	4,330	5.0	2.0	6.5
	Trenton, N.J.	1944–78	13,430	65	130	.....	631	20,500	.....	0	11.0
	(Morrisville, Pa.)	(Extreme yr)		(1949)	(1975)		(1964)	(1973)			
			[c]10,750								
04264331	St. Lawrence River at	1979	288,000	165	168	130,000	119,000	136,000	4.0	1.5	8.0
	Cornwall, Ontario, near	1975–78	245,900	163	170	111,000	88,000	135,000	2.0	0.5	7.0
	Massena, N.Y.	(Extreme yr)		(1978)	(1975)		(1978)	(1977)			
	median streamflow at Ogdensburg, N.Y.		[c]229,500								
	SOUTHEAST										
07289000	Mississippi River at	1979	746,200	188	219	412,000	320,000	511,000	9.5	7.0	11.0
	Vicksburg, Miss.	1975–78	640,200	153	281	337,000	131,000	491,000	7.0	3.5	12.5
		(Extreme yr)		(1978)	(1978)		(1976)	(1978)			
			[c]365,200								
	WESTERN GREAT LAKES REGION										
03612500	Ohio River at lock and dam	1979	471,000	155	200	.....	140,000	344,000	.....	7.0	9.0
	53, near Grand Chain, Ill.	1954–78	311,400	133	362	.....	26,200	469,000	.....	0	14.0
	(25 miles west of Paducah,	(Extreme yr)		(1962)	(1969)		(1955)	(1977)			
	Ky.; streamflow station		[c]173,000								
	at Metropolis, Ill.)										
	MIDCONTINENT										
06934500	Missouri River at Hermann,	1979	55,700	430	489	69,800	58,500	84,900	4.0	2.0	5.5
	Mo. (60 miles west of St.	1975–78	51,120	304	770	56,800	35,000	133,000	3.0	0	7.0
	Louis, Mo.)	(Extreme yr)		(1977)	(1978)		(1976)	(1975)			
			[c]29,940								
	WEST										
14128910	Columbia River at	1979	135,900	103	117	40,800	31,800	54,100	7.5	6.5	9.0
	Warrendale, Oreg.	1975–78	157,000	82	119	43,700	22,800	68,300	7.0	0.5	10.5
	(streamflow station	(Extreme yr)		(1975)	(1978)		(1978)	(1978)			
	at The Dalles, Oreg.)		[c]112,800								

[a]Dissolved-solids concentrations when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]To convert °C to °F: [(1.8 X °C) + 32] = °F.
[c]Median of monthly values for 30-year reference period, water years 1941–70, for comparison with data for current month.
*Dissolved solids and water temperatures are for 29 days only.

Provisional data; subject to revision

USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF DECEMBER 1979

[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

Reservoir Principal uses: F–Flood control I–Irrigation M–Municipal P–Power R–Recreation W–Industrial	End of Nov. 1979	End of Dec. 1979	End of Dec. 1978	Average for end of Dec.	Normal maximum
	Percent of normal maximum				
NORTHEAST REGION					
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	67	68	27	49	226,300 (a)
QUEBEC					
Allard (P)	77	77	64	55	280,600 ac-ft
Gouin (P)	84	89	57	62	6,954,000 ac-ft
MAINE					
Seven reservoir systems (MP)	60	56	34	56	178,500 mcf
NEW HAMPSHIRE					
First Connecticut Lake (P)	66	63	21	58	3,330 mcf
Lake Francis (FPR)	76	71	71	69	4,326 mcf
Lake Winnipesaukee (PR)	86	75	46	61	7,220 mcf
VERMONT					
Harriman (P)	81	75	24	58	5,060 mcf
Somerset (P)	71	68	72	66	2,500 mcf
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	79	79	62	72	3,394 mcf
NEW YORK					
Great Sacandaga Lake (FPR)	63	49	37	53	34,270 mcf
Indian Lake (FMP)	92	85	60	61	4,500 mcf
New York City reservoir system (MW)	84	88	61	.....	547,500 mg
NEW JERSEY					
Wanaque (M)	96	98	41	72	27,730 mg
PENNSYLVANIA					
Allegheny (FPR)	32	24	28	30	51,400 mcf
Pymatuning (FMR)	95	86	87	80	8,191 mcf
Raystown Lake (FR)	64	68	68	45	33,190 mcf
Lake Wallenpaupack (PR)	75	72	58	55	6,875 mcf
MARYLAND					
Baltimore municipal system (M)	101	100	86	85	85,340 mg
SOUTHEAST REGION					
NORTH CAROLINA					
Bridgewater (Lake James) (P)	100	91	75	75	12,580 mcf
Narrows (Badin Lake) (P)	95	93	99	94	5,616 mcf
High Rock Lake (P)	66	45	50	63	10,230 mcf
SOUTH CAROLINA					
Lake Murray (P)	78	74	79	58	70,300 mcf
Lakes Marion and Moultrie (P)	79	63	62	59	81,100 mcf
SOUTH CAROLINA--GEORGIA					
Clark Hill (FP)	73	62	45	51	75,360 mcf
GEORGIA					
Burton (PR)	94	82	69	50	104,000 ac-ft
Sinclair (MPR)	95	95	76	71	214,000 ac-ft
Lake Sidney Lanier (FMPR)	63	62	39	50	1,686,000 ac-ft
ALABAMA					
Lake Martin (P)	78	71	72	58	1,373,000 ac-ft
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	38	35	34	31	1,156,000 cfsd
Douglas Lake (FPR)	49	12	13	10	703,100 cfsd
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	60	39	40	37	510,300 cfsd
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	53	44	39	30	1,452,000 cfsd
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	70	51	43	37	745,200 cfsd
WESTERN GREAT LAKES REGION					
WISCONSIN					
Chippewa and Flambeau (PR)	88	69	72	62	15,900 mcf
Wisconsin River (21 reservoirs) (PR)	78	67	59	52	17,400 mcf
MINNESOTA					
Mississippi River headwater system (FMR)	27	23	25	24	1,640,000 ac-ft
MIDCONTINENT REGION					
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	89	87	84	86	22,700,000 ac-ft
SOUTH DAKOTA					
Angostura (I)	91	92	93	72	127,600 ac-ft
Bell Fourche (I)	35	41	61	44	185,200 ac-ft
Lake Francis Case (FIP)	51	54	58	57	4,834,000 ac-ft
Lake Oahe (FIP)	83	82	81	.....	22,530,000 ac-ft
MIDCONTINENT REGION--Continued					
SOUTH DAKOTA--Continued					
Lake Sharpe (FIP)	103	103	102	94	1,725,000 ac-ft
Lewis and Clarke Lake (FIP)	95	97	90	91	477,000 ac-ft
NEBRASKA					
Lake McConaughy (IP)	76	78	63	69	1,948,000 ac-ft
OKLAHOMA					
Eufaula (FPR)	94	93	76	81	2,378,000 ac-ft
Keystone (FPR)	108	93	77	93	661,000 ac-ft
Tenkiller Ferry (FPR)	96	97	88	90	628,200 ac-ft
Lake Altus (FIMR)	60	62	44	49	134,600 ac-ft
Lake O'The Cherokees (FPR)	104	77	72	78	1,492,000 ac-ft
OKLAHOMA--TEXAS					
Lake Texoma (FMPRW)	92	91	81	89	2,722,000 ac-ft
TEXAS					
Bridgeport (IMW)	38	37	33	43	386,400 ac-ft
Canyon (FMR)	91	92	99	71	385,600 ac-ft
International Amistad (FIMPW)	123	121	111	82	3,497,000 ac-ft
International Falcon (FIMPW)	91	96	100	78	2,668,000 ac-ft
Livingston (IMW)	100	100	88	78	1,788,000 ac-ft
Possum Kingdom (IMPRW)	88	87	93	99	569,400 ac-ft
Red Bluff (PI)	23	24	33	30	307,000 ac-ft
Toledo Bend (P)	91	88	89	79	4,472,000 ac-ft
Twin Buttes (FIM)	41	43	62	30	177,800 ac-ft
Lake Kemp (IMW)	50	52	57	86	268,000 ac-ft
Lake Meredith (FMW)	29	28	34	38	821,300 ac-ft
Lake Travis (FIMPRW)	86	87	72	77	1,144,000 ac-ft
THE WEST					
WASHINGTON					
Ross (PR)	74	79	67	68	1,052,000 ac-ft
Franklin D. Roosevelt Lake (IP)	66	95	89	95	5,022,000 ac-ft
Lake Chelan (PR)	58	53	58	55	676,100 ac-ft
Lake Cushman	84	99	65	85	359,500 ac-ft
Lake Merwin (P)	101	98	101	95	245,600 ac-ft
IDAHO					
Boise River (4 reservoirs) (FIP)	41	44	64	57	1,235,000 ac-ft
Coeur d'Alene Lake (P)	38	47	31	55	238,500 ac-ft
Pend Oreille Lake (FP)	35	35	35	50	1,561,000 ac-ft
IDAHO--WYOMING					
Upper Snake River (8 reservoirs) (MP)	47	56	76	62	4,401,000 ac-ft
WYOMING					
Boysen (FIP)	78	76	77	74	802,000 ac-ft
Buffalo Bill (IP)	51	50	64	68	421,300 ac-ft
Keyhole (F)	76	75	78	44	190,400 ac-ft
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	55	56	51	44	3,056,000 ac-ft
COLORADO					
John Martin (FIR)	2	3	0	13	364,400 ac-ft
Taylor Park (IR)	76	73	56	53	106,200 ac-ft
Colorado–Big Thompson project (I)	65	65	41	54	722,600 ac-ft
COLORADO RIVER STORAGE PROJECT					
Lake Powell: Flaming Gorge, Fontenelle, Navajo, and Blue Mesa Reservoirs (IFPR)	81	80	65	.....	31,620,000 ac-ft
UTAH--IDAHO					
Bear Lake (IPR)	66	66	69	56	1,421,000 ac-ft
CALIFORNIA					
Folsom (FIP)	61	59	64	50	1,000,000 ac-ft
Hetch Hetchy (MP)	50	44	56	35	360,400 ac-ft
Isabella (FIR)	37	37	43	23	570,000 ac-ft
Pine Flat (FI)	53	55	66	44	1,001,000 ac-ft
Clair Engle Lake (Lewiston) (P)	68	70	64	71	2,438,000 ac-ft
Lake Almanor (P)	63	60	76	46	1,036,000 ac-ft
Lake Berryessa (FIMW)	64	64	68	76	1,600,000 ac-ft
Millerton Lake (FI)	37	44	64	53	503,200 ac-ft
Shasta Lake (FIPR)	75	75	76	66	4,377,000 ac-ft
CALIFORNIA--NEVADA					
Lake Tahoe (IPR)	7	5	8	47	744,600 ac-ft
NEVADA					
Rye Patch (I)	45	46	23	51	194,300 ac-ft
ARIZONA--NEVADA					
Lake Mead and Lake Mohave (FIMP)	86	87	84	67	27,970,000 ac-ft
ARIZONA					
San Carlos (IP)	76	75	45	13	1,073,000 ac-ft
Salt and Verde River system (IMPR)	76	76	89	37	2,073,000 ac-ft
NEW MEXICO					
Conchas (FIR)	43	43	26	77	352,600 ac-ft
Elephant Butte and Caballo (FIPR)	36	39	9	27	2,539,000 ac-ft

[a]Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

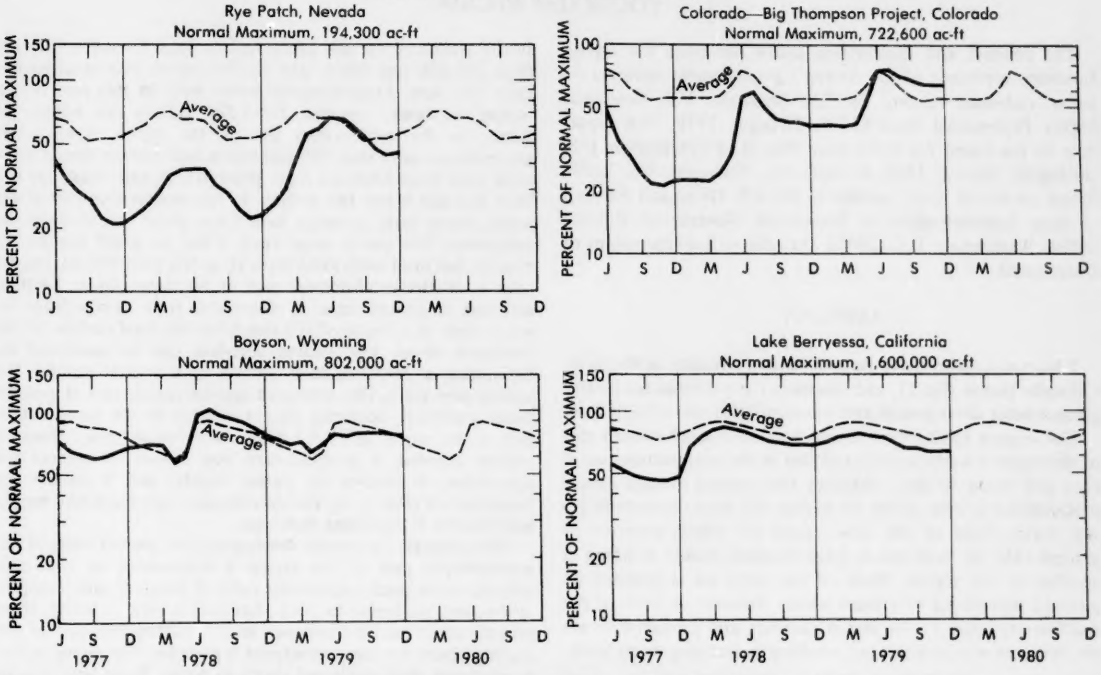
*Dissolved solids and water temperatures

FLOW OF LARGE RIVERS DURING DECEMBER 1979

Station number*	Stream and place of determination	Drainage area (square miles)	Mean annual discharge through September 1975 (cfs)	December 1979					
				Monthly discharge (cfs)	Percent of median monthly discharge, 1941–70	Change in discharge from previous month (percent)	Discharge near end of month		
							(cfs)	(mgd)	Date
1–0140	St. John River below Fish River at Fort Kent, Maine	5,690	9,549	6,257	141	-16	6,100	3,940	31
1–3185	Hudson River at Hadley, N.Y	1,664	2,853	3,394	151	-1	3,200	2,070	31
1–3575	Mohawk River at Cohoes, N.Y	3,456	5,630	4,240	76	-31	.....	.....	.....
1–4635	Delaware River at Trenton, N.J	6,780	11,630	11,670	109	-20	15,800	10,200	26
1–5705	Susquehanna River at Harrisburg, Pa	24,100	34,200	36,040	124	-18	50,000	32,300	26
1–6465	Potomac River near Washington, D.C	11,560	[1] 11,190	13,790	171	-18	16,170	10,450	31
2–1055	Cape Fear River at William O. Huske Lock near Tarheel, N.C	4,810	5,007	3,773	103	-60	3,662	2,370	31
2–1310	Pee Dee River at Peedee, S.C	8,830	9,657	9,020	131	-35	6,250	4,040	26
2–2260	Altamaha River at Doctortown, Ga	13,600	13,780	8,881	123	+15	7,600	4,910	27
2–3205	Suwannee River at Branford, Fla	7,880	6,970	4,780	139	+14	5,390	3,480	28
2–3580	Apalachicola River at Chattahoochee, Fla	17,200	22,330	16,500	102	-1	11,900	7,690	28
2–4670	Tombigbee River at Demopolis lock and dam near Coatopa, Ala	15,400	22,570	29,660	164	-11	14,500	9,370	31
2–4895	Pearl River near Bogalusa, La	6,630	9,263	24,240	506	+335	14,500	9,370	31
3–0495	Allegheny River at Natrona, Pa	11,410	[1] 19,210	32,600	168	+85	61,400	39,700	26
3–0850	Monongahela River at Braddock, Pa	7,337	[1] 12,360	14,600	105	-1	28,600	18,500	26
3–1930	Kanawha River at Kanawha Falls, W.Va	8,367	12,530	13,920	107	-36	28,300	18,300	26
3–2345	Scioto River at Higby, Ohio	5,131	4,513	7,726	475	-3	17,600	11,400	27
3–2945	Ohio River at Louisville, Ky[2]	91,170	114,100	166,800	188	+8	203,000	131,000	25
3–3775	Wabash River at Mount Carmel, Ill	28,635	27,030	46,210	308	+95	71,000	45,900	31
3–4690	French Broad River below Douglas Dam, Tenn	4,543	[1] 6,794	7,142	141	-50	.....	.....	.....
4–0845	Fox River at Rapide Croche Dam, near Wrightstown, Wis[2]	6,150	4,185	4,530	137	+18	.....	.....	.....
02MC002 (4–2643.31)	St. Lawrence River at Cornwall, Ontario–near Massena, N.Y[3]	299,000	241,100	288,500	126	0	305,000	197,000	31
050115	St. Maurice River at Grand Mere, Quebec	16,300	25,300	28,500	224	+56	21,800	14,100	28
5–0825	Red River of the North at Grand Forks, N. Dak	30,100	2,524	1,613	184	-17	1,200	780	31
5–1335	Rainy River at Manitou Rapids, Minn	19,400	12,950	9,620	102	0	10,300	6,660	20
5–3300	Minnesota River near Jordan, Minn	16,200	3,412	3,730	572	-43	3,450	2,230	21
5–3310	Mississippi River at St. Paul, Minn	36,800	[1] 10,580	9,320	198	-46	9,300	6,010	21
5–3655	Chippewa River at Chippewa Falls, Wis	5,600	5,110	3,200	112	-25	.....	.....	.....
5–4070	Wisconsin River at Muscoda, Wis	10,300	8,613	7,570	133	-13	.....	.....	.....
5–4465	Rock River near Joslin, Ill	9,551	5,852	6,060	198	+41	5,490	3,550	31
5–4745	Mississippi River at Keokuk, Iowa	119,000	62,570	52,552	154	-23	59,000	38,100	31
6–2145	Yellowstone River at Billings, Mont	11,796	6,986	2,810	95	-12	2,950	1,910	31
6–9345	Missouri River at Hermann, Mo	524,200	79,750	55,650	186	-16	51,200	33,100	26
7–2890	Mississippi River at Vicksburg, Miss[4]	1,140,500	573,600	746,200	204	+40	674,000	436,000	26
7–3310	Washita River near Durwood, Okla	7,202	1,414	242	56	-49	220	140	31
8–2765	Rio Grande below Taos Junction Bridge, near Taos, N. Mex	9,730	724	392	84	+27	395	256	31
9–3150	Green River at Green River, Utah	40,600	6,366	1,230	60	-35	2,700	1,750	31
11–4255	Sacramento River at Verona, Calif	21,257	19,150	16,500	81	+35	50,000	32,000	27
13–2690	Snake River at Weiser, Idaho	69,200	18,170	10,930	73	-8	11,200	7,240	26
13–3170	Salmon River at White Bird, Idaho	13,550	11,290	3,746	86	-3	3,640	2,350	26
13–3425	Clearwater River at Spalding, Idaho	9,570	15,570	11,230	170	+98	3,980	2,570	26
14–1057	Columbia River at The Dalles, Oreg[5]	237,000	194,600	58,270	65	+13	.....	.....	.....
14–1910	Willamette River at Salem, Oreg	7,280	23,810	36,210	84	+100	33,090	21,400	27–31
15–5155	Tanana River at Nenana, Alaska	25,600	23,850	5,823	87	-31	5,500	3,550	31
8MF005	Fraser River at Hope, British Columbia	83,800	96,400	33,200	79	+1	28,400	18,400	27

[1] Adjusted.
[2] Records furnished by Corps of Engineers.
[3] Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y. when adjusted for storage in Lake St. Lawrence.
[4] Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.
[5] Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.
*The U.S. station numbers as listed in this table are in a shortened form previously in use, and used here for simplicity of tabular and map presentation. The full, correct number contains 8 digits and no punctuation marks. For example, the correct form for station number 1–3185 is 01318500.

USABLE CONTENTS OF SELECTED RESERVOIRS AND RESERVOIR SYSTEMS, JUNE 1977 TO DECEMBER 1979



Near- or above-average contents characterized most reservoirs in the West during December. Monthend contents of Lake Berryessa in California, however, remained below average since January 1976.

WATER RESOURCES REVIEW

December 1979

Based on reports from the Canadian and U.S. field offices; completed January 15, 1980

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EXPLANATION OF DATA

Cover map shows generalized pattern of streamflow for December based on 20 index stream-gaging stations in Canada and 130 index stations in the United States. Alaska and Hawaii inset maps show streamflow only at the index gaging stations which are located near the points shown by the arrows.

Streamflow for December 1979 is compared with flow for December in the 30-year reference period 1941–70. Streamflow is considered to be *below the normal range* if it is within the range of the low flows that have occurred 25 percent of the time (below the lower quartile) during the reference period. Flow for December is considered to be *above the normal range* if it is within the range of the high flows that have occurred 25 percent of the time (above the upper quartile).

Flow higher than the lower quartile but lower than the upper quartile is described as being *within the normal range.* In the Water Resources Review the median is obtained by ranking the 30 flows of the reference period in their order of magnitude; the highest flow is number 1, the lowest flow is number 30, and the average of the 15th and 16th highest flows is the median.

The normal is an average (but not an arithmetic average) or middle value; half of the time you would expect the December flows to be below the median and half of the time to be above the median. Shorter reference periods are used for the Alaska index stations because of the limited records available.

Statements about *ground-water levels* refer to conditions near the end of December. Water level in each key observation well is compared with average level for the end of December determined from the entire past record for that well or from a 20-year reference period, 1951–70. *Changes in ground-water levels,* unless described otherwise, are from the end of November to the end of December.

The Water Resources Review is published monthly. Special-purpose and summary issues are also published. Issues of the Review are free on application to the Water Resources Review, U.S. Geological Survey, Reston, Virginia 22092.

SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES—LOWER COLORADO REGION

The abstract and illustrations below are from the report, *Summary appraisals of the Nation's ground-water resources—lower Colorado region,* by E.S. Davidson: U.S. Geological Survey Professional Paper 813-R, 23 pages, 1979. This report may be purchased for $3.00 from Branch of Distribution, U.S. Geological Survey, 1200 S. Eads St., Arlington, Va. 22202 (check or money order payable to the U.S. Geological Survey); or from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402 (payable to Superintendent of Documents).

ABSTRACT

This report summarizes ground-water availability in the lower Colorado region (fig. 1), and discusses the potential for greater ground-water development and increased efficiency of water use.

The climate in the most highly developed southwestern part of the region is warm and dry and that in the northeastern part is cool and moist to dry. Although the regional average annual precipitation is only about 14 inches and most streambeds are dry during most of the year, about 1.5 billion acre-feet of ground water of moderate to good chemical quality is stored in aquifers of the region. Much of the water use is founded on pumped withdrawal of ground water. However, in most of the southwestern part of the region pumpage and consumptive use are in excess of replenishment, resulting in declining water levels.

In the southwestern part of the region, water levels generally are from 200-500 feet below land surface and in large areas are less than 200 feet. Large-diameter water wells in this part of the region commonly produce 500-1,500 gallons per minute of water. In the northeastern part of the region, water levels generally are more than 500 feet below land surface, but in some large areas water levels are from 200-500 feet, and locally are less than 200 feet below the surface. In the northeastern part of the region, water wells generally have lower yields than those to the southwest. The yields range from a few to 2,000 gallons per minute, but most wells yield from 10 to less than 500 gallons per minute. In the southwestern part of the region about 1 billion acre-feet of ground water is recoverable from storage from the water table to a depth of 700 feet below the land surface. In the northeast about 150 million acre-feet can be recovered by dewatering a 100-foot-thick section of a typical aquifer (16 million-acre area). The estimated current annual rate of ground-water depletion, occurring almost entirely in the southwestern part of the region, is 2.4-3.2 million acre-feet per year. Almost 6 million acre-feet is pumped each year—about 90 percent for agriculture, 6 percent for public supply, and 3 percent for industrial use (figs. 2, 3). The percentage of use for public supply and industry is increasing each year.

The potential for greater development of ground water in the southwestern part of the region is constrained by land subsidence, earth cracks, increasing costs of pumping and transportation, and moderate to poor chemical quality of water. More ground water can be developed in the northeastern part of the region, where the major constraint is pumping cost owing to low to moderate well yields and depth to water. Some benefits can be realized everywhere in the region through changes in current use and greater efficiencies of use. Additional supplies may be made available by capture of natural evapotranspiration. Increasing the efficiency of use is possible hydrologically but, in the near term, is more expensive than increasing ground-water development. Decrease of irrigation, change to water-saving methods of irrigation, use of saline water, decrease of per capita public-supply use, and more reuse of water in almost every type of use could help extend the supply and thereby reduce the current rate of ground-water depletion. Financial problems have not yet caused an overall decrease in pumpage, but, locally, operating costs or partial dewatering of the aquifer has eliminated or decreased withdrawal. Current water laws in all States of the region, except Arizona, control or allocate the use of ground water.

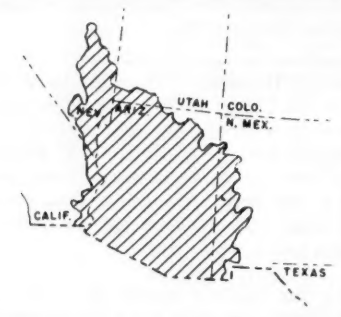

Figure 1.—Map showing location of lower Colorado region.

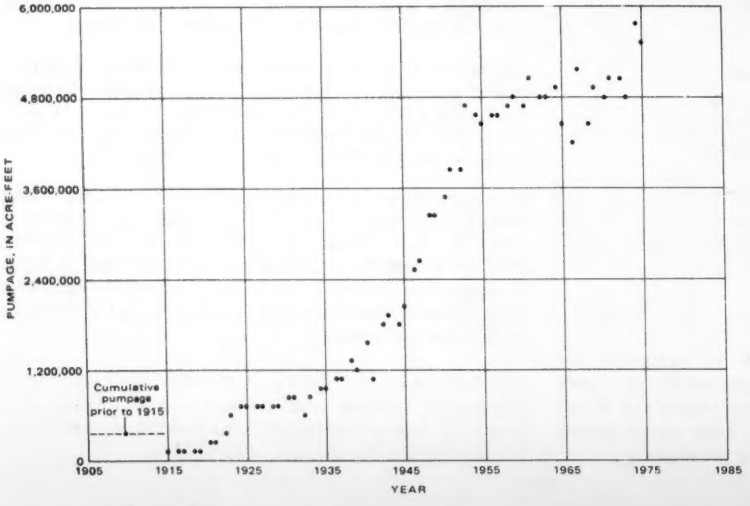

Figure 2.—Pumpage in Arizona from prior to 1915 to 1975.

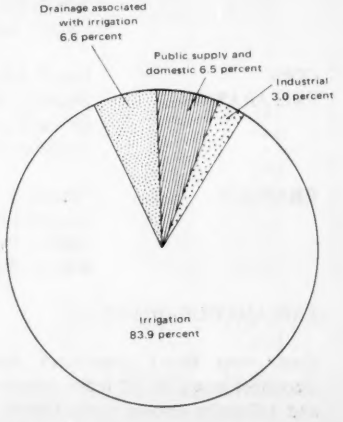

Figure 3.—Major uses of ground water pumped in the lower Colorado region in 1975.